



SYSTEMS ENGINEERING  
Research Center

A US DoD University Affiliated Research Center

Annual SERC Research Review:  
*Rapid Dissemination of SERC  
Research Results into Practice and  
Education*

November 9-10, 2010

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# SERC Objectives

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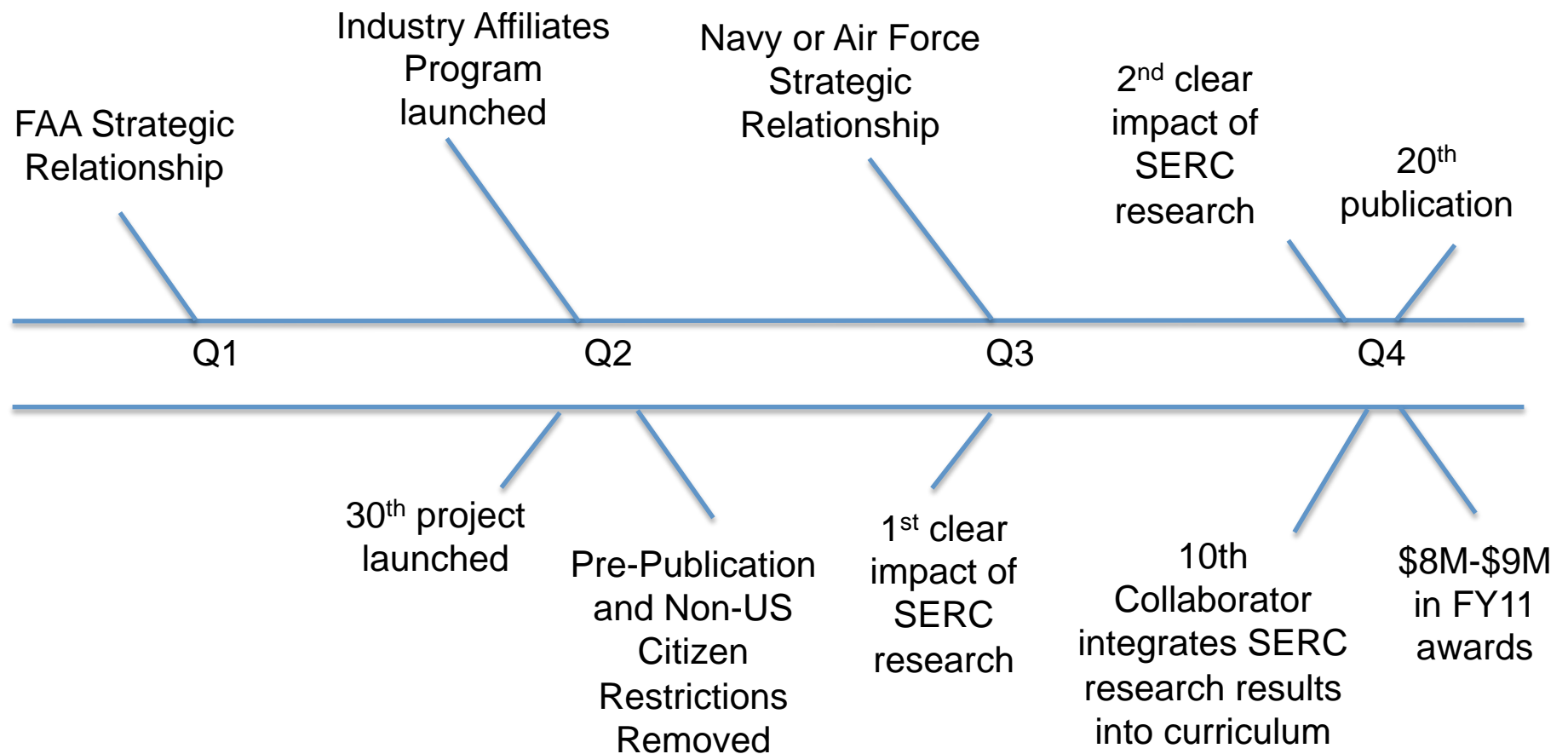
**TRANSFORM** systems engineering practice throughout the DoD and IC by creating innovative methods, processes, and tools that address critical challenges to meeting mission outcomes (*what we do*),

**CATALYZE** community growth among systems engineering researchers by enabling collaboration among many research organizations (*who does it*),

**ACCELERATE** systems engineering competency development through rapid transfer of research to educators and practitioners (*how we impact others*).

# Possible FY11 Milestones

*Moderate Growth, New Ways to Interact, Impact*



# Two Projects as Examples

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- Body of Knowledge and Curriculum to Advance Systems Engineering
- Experience Accelerator

Dissemination and adoption are integral to both projects

# What is BKCASE?

- Project to create:
  - Systems Engineering Body of Knowledge
  - Graduate Reference Curriculum in Systems Engineering (GRCSE™ – pronounced “Gracie”)
- Started in September 2009 by Stevens Institute of Technology and Naval Postgraduate School with primary support from Department of Defense
- Project will run through 2012
- Intended for world-wide use



# What is the SEBoK?

Describes the boundaries, terminology, content, and structure of SE that are needed to systematically and consistently *support and enable*:

Task Name	Task Description
<i>Inform Practice</i>	Inform systems engineers about the boundaries, terminology, and structure of their discipline and point them to useful information needed to practice SE in any application domain
<i>Inform Research</i>	Inform researchers about the limitations and gaps in current SE knowledge that should help guide their research agenda
<i>Define Curricula</i>	Define the content that should be common in undergraduate and graduate programs in SE
<i>Certify Professionals</i>	Certify individuals as qualified to practice systems engineering
<i>Decide Competencies</i>	Decide which competencies practicing systems engineers should possess in various roles ranging from apprentice to expert

Guide to the literature, not all the content of the literature

# What is in GRCSE?

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- ***Guidance for Constructing and Maintaining the Reference Curriculum:*** the fundamental principles, assumptions, and context for the reference curriculum authors
- ***Entrance Expectations:*** what students should be capable of and have experienced before they enter a graduate program
- ***Objectives:*** what students should be able to achieve 3 to 5 years after graduation based on what they learn in program
- ***Outcomes:*** what students should achieve by graduation
- ***Architecture:*** the structure of a curriculum to accommodate core material, university-specific material, and elective material
- ***Core Body of Knowledge:*** material that all students should master in a graduate SE program

Not specific courses. Not specific packaging. Adaption and selective adoption expected and encouraged.



# BKCASE Project Characteristics

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1. Consistent direction and significant funding over a 3 year period – about \$500K per year – provides stable pool of strong researchers
2. Sponsor values community awareness and input and considers adoption critical to project success
3. Highly collaborative and open
4. Products will be available at no cost

# BKCASE - Spreading the Word

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1. The BKCASE author team has delivered about a dozen talks in its first year, targeting every major systems engineering conference. In several cases, those talks included accompanying papers.
2. BKCASE has published introductory papers in INCOSE INSIGHT and CrossTalk
3. BKCASE maintains a standard set of slides that all team members can draw on
4. BKCASE maintains a website that includes all major information about the project
5. Pyster is presenting an INCOSE Webinar on BKCASE on November 17

## BKCASE - Adoption

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6. BKCASE interim products are being reviewed by more than 200 people worldwide. Some will likely become early adopters
7. Potential early adopters involved in project from beginnings to help guide project to ensure its utility
8. Transition strategy developed early – transfer stewardship of BKCASE products to INCOSE and IEEE when version 1.0 published

# What is The Experience Accelerator?

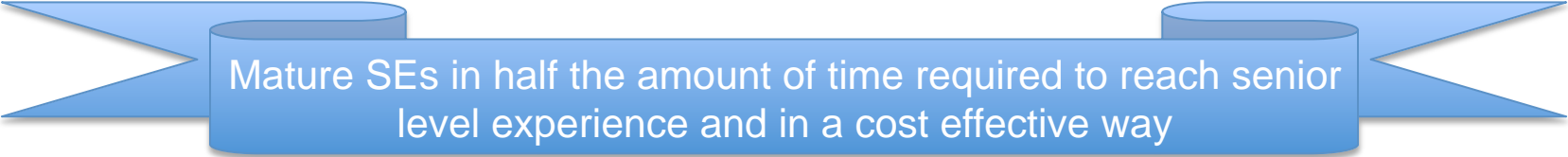
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## **Problem Statement:**

Traditional SE education is not adequate to meet the emerging challenges posed by ever increasing systems and societal demands. It fails to educate the workforce called upon to meet those challenges quickly enough.

## **Program Goal:**

Transform the education of SE by creating a new paradigm capable of halving the time to mature a senior SE while providing the skills necessary to address emerging system challenges.



Mature SEs in half the amount of time required to reach senior level experience and in a cost effective way

# Required New Paradigm

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- **Experience Based:** Providing accelerated learning opportunities through experience based, interactive sessions
- **Agile:** Allowing for quality, timely development of course material that is most appropriate for the target students
- **Integrated:** Providing an integration point of multi-disciplinary skills and a wide range SE knowledge in a setting that recreates the essential characteristics of the practicing environment
- **Lean:** Providing the greatest amount of benefits with the minimal number of steps and least amount of effort

# Required New Paradigm

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- **Leveraged:** Enabling capability growth through the leveraging of computational and information technologies and prior Systems work
- **Extensible:** Providing the capability to expand and enhance capabilities for future growth without having to make major changes in the infrastructure
- **Implementable:** Enabling widespread impact through economically viable, rapid development and deployment of educational and training programs for participants with multiple levels of competence and background

The Experience Accelerator will be a training simulation intended for life-long learning

# EA Project Characteristics

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1. Consistent direction and significant funding over a 3 year period – about \$800K per year – provides stable pool of strong researchers
2. Sponsor values community awareness and input and considers adoption critical to project success
3. Highly collaborative and open
4. Software being created will likely become open source

# Project Approach

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1. Iterative development and application of the EA by DAU to educate a pool of systems engineers
2. Pilot courses offered each year with increasing capability and sophistication
3. Students must be able to immediately take back insights and learning onto the job
4. EA software constructed in such a way that others will be able to easily extend it for additional learning modules



# My Thoughts?

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1. All research tasks that are expected to have significant impact must be multi-year with stable significant funding of at least \$500K annually
2. Every research task should have as one of its deliverables at least one conference paper annually and at least one journal paper by project completion.
3. Every research task should have a transition partner identified within 6 months after task start, develop an explicit transition strategy at its start, and include transition activities throughout task execution.
4. Every research task should identify courses in several universities that agree to adopt research results

# Your Thoughts...